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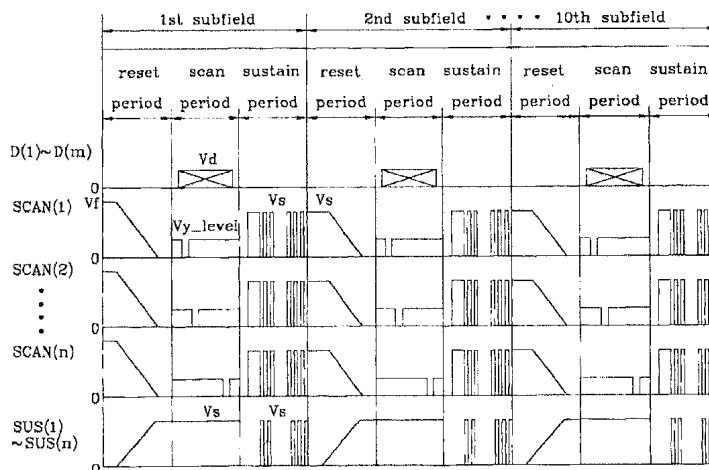
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- (71) Applicant (for all designated States except US): **ORION ELECTRIC CO., LTD.** [KR/KR]; 165, Gong Dan-dong, 730-030 Gumi, Kyung Sang Buk Do (KR).
- (74) Agent: **LEE, Young**; 2FL., Ssangma Building, 828-23, Yoeksam-dong, Kangnam-ku, 135-080 Seoul (KR).
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- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **HAN, Jung-Gwan**

(54) Title: METHOD OF DRIVING A AC-TYPE PLASMA DISPLAY PANEL.



(57) **Abstract:** Disclosed is a method of driving an AC plasma display panel, wherein charge control is easy, a reset voltage can be lowered, a high contrast and a high brightness can be obtained by using a positive electric power source only, and false contour can be decreased. The method is characterized in that: a voltage (pulse wave) abruptly increased to a voltage for starting a discharge (Vf) is applied to the scan electrodes in the reset period of a first subfield of each frame; the voltage is maintained at the discharge starting voltage (Vf) for a discharge stabilizing time after the discharge starts for which wall charges are sufficiently accumulated on a dielectric layer covering the scan electrodes, the sustain electrodes and the data electrodes; subsequently, the voltage is slowly decreased to OV; and a voltage of OV is applied to the sustain electrodes while the discharge starting voltage (Vf) is applied to the scan electrodes, and then the voltage is slowly increased to about a sustain voltage (Vs) while the voltage to be applied to the sustain electrodes is slowly decreased from the discharge starting voltage (Vf).



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Title of the Invention

METHOD OF DRIVING A AC-TYPE PLASMA DISPLAY PANEL

Technical Field

The present invention relates to a method of driving an
5 alternating current type plasma display panel, and more
particularly, to a method of driving an AC plasma display panel,
wherein charge control is easy, a reset voltage can be lowered, a
high contrast and a high brightness can be obtained by using a
positive electric power source only, and false contour can be
10 decreased.

Background Art

As shown in Figs. 1 and 2, a Pulse_Reset ADS method of
Fujitsu Limited, and a Ramp_Reset ADS method of Matsushita
Electric Industrial Co., Ltd., are widely used as recent wave
15 forms.

But, since strong light is emitted due to a strong
discharge of a pulse reset wave in the Pulse_Reset ADS method of
Fujitsu Limited shown in Fig. 1, it is one problem that a contrast
becomes lowered. Furthermore, other problems are that unstable
20 phenomena of discharges in the scan period occur since an erase

operation in a reset period is not performed properly, and non-selective cells are discharged due to a voltage regulation of y_level, thereby causing a problem on charge control.

The Ramp_Reset ADS method of Matsushita Electric Industrial Co., Ltd., shown in Fig. 2 comprises a reset period in each subfield, thereby it being difficult to make a plurality of subfields. Such a reset period is substantially long. Therefore, a sustain frequency is limited, and a sustain voltage is high, thereby consuming much electric power. Also, in a driving waveform newly developed by Matsushita Electric Industrial Co., a high reset voltage and a negative electric power source are required, and therefore it is disadvantageous that driving circuits become complicated.

Disclosure of Invention

Accordingly, the present invention is made in order to solve the above problems, and one object of the present invention is to provide a method of driving an AC plasma display panel, in which charge control can be easily made, a reset voltage can be lowered, a high contrast and a high brightness can be obtained by using a positive electric power source only, and/or false contour

can be decreased.

To accomplish the object of this invention, a method of driving an AC plasma display panel is provided in accordance with one embodiment of the invention, which comprises multiple scan electrodes and multiple sustain electrodes to be arranged in parallel on one surface of opposite surfaces of a front substrate and a rear substrate, and multiple data electrodes to be arranged on other surface of opposite surfaces of the front substrate and the rear substrate so as to form each display cell for discharge in each region crossing with the scan electrodes and the sustain electrodes, wherein one frame of inputted video signals is divided into multiple subfields each of which comprises a reset period, a scan period and a sustain period, wall charges being accumulated uniformly on all display cells during the reset period, selective write discharges being executed on display cells to be turned on during the scan period, and sustain discharges being executed so as to turn on the write-discharged display cells during the sustain period, said sustain period being differently set with specific weighted values in each divided subfield, so as to display gray scales by combining each subfield, said method being

characterized in that: a voltage (pulse wave) abruptly increased to a voltage for starting a discharge is applied to the scan electrodes in the reset period of a first subfield of each frame; the voltage to be applied to the scan electrodes is maintained at the discharge starting voltage for a discharge stabilizing time after the discharge starts for which wall charges are sufficiently accumulated on a dielectric layer covering the scan electrodes, the sustain electrodes and the data electrodes; subsequently, the voltage to be applied to the scan electrodes is slowly decreased to 0V from the discharge starting voltage; and a voltage to be applied to the sustain electrodes is maintained at 0V while the discharge starting voltage is applied to the scan electrodes, and then is slowly increased from 0V to about a sustain voltage while the voltage to be applied to the sustain electrodes is slowly decreased to 0V from the discharge starting voltage.

The step of slowly decreasing the voltage from the discharge starting voltage to 0V may comprise the steps of abruptly dropping the voltage from the discharge starting voltage to a voltage at which a self-erase discharge is not generated, and then slowly decreasing the voltage to 0V.

Furthermore, a method of driving an AC plasma display panel is provided in accordance with another embodiment of the invention, which is characterized in that: during the reset period in any one subfield of a second to a last subfield of the frame, the sustain voltage is applied to the scan electrodes for a discharge stabilizing time within a time of $15\mu\text{s}$ after a last sustain voltage of a previous subfield is applied, and then is slowly decreased to 0V; and a voltage to be applied to the sustain electrodes is maintained at 0V while the sustain voltage is applied to the scan electrodes, and then is slowly increased to about the sustain voltage while the voltage to be applied to the scan electrodes is slowly decreased to 0V.

Brief Description of Drawings

Fig. 1 is a waveform diagram for driving the conventional plasma display panel in a prior art selective write address method.

Fig. 2 is a waveform diagram for driving the conventional plasma display panel in another prior art selective write address method.

Fig. 3 is a waveform diagram for a method of driving the

conventional plasma display panel in accordance with one embodiment of the present invention.

Fig. 4 is a waveform diagram for a method of driving the conventional plasma display panel in accordance with another embodiment of the present invention.

Fig. 5 is a waveform diagram for a method of driving the conventional plasma display panel in accordance with further another embodiment of the present invention.

Figs. 6 to 8 are graphs illustrating relations of a write voltage (V_d) to a sustain voltage (V_s) according to a change in each cell-off voltage of R, B and G display cells, respectively.

Fig. 9 is a graph illustrating a contrast ratio between a black color and a white color by each reset voltage according to one method of the present invention.

Fig. 10 is a graph illustrating a light emission state in a reset period of a first subfield.

Fig. 11 is a graph illustrating a light emission state in a reset period below a second subfield in case of a white discharge.

Best Mode for Carrying out the Invention

The invention will now be described by way of

non-limitative example(s) with reference to the following drawings.

In Figs. 3 to 5, waveform diagrams for a method of driving the conventional plasma display panel in accordance with several
5 embodiments of the present invention are illustrated.

A sustain voltage (V_s) of a voltage value below 200V is selected for example as a peak voltage applied to a sustain electrode in a reset period, and the sustain voltage (V_s) of a voltage value below 200V is selected for example as a peak voltage
10 applied to a scan electrode in a second to a tenth subfield.

The sustain voltage (V_s) of a voltage value below 200V is selected for example as a voltage applied to the sustain electrode in the scan period, and a voltage of V_{y_level} to be applied to the scan electrode is set to around 50V for example.

15 In a timing chart of Buffy Driving Waveform according to one embodiment of the present invention shown in Fig. 3, all data electrodes are set to 0V during a reset period of a first subfield. A voltage (pulse wave) abruptly increased to a voltage (V_f) for starting a discharge is applied to the scan electrodes,
20 and the voltage to be applied to the scan electrodes is maintained

at the discharge starting voltage (V_f) for a discharge stabilizing time (9 to $11\mu s$) for which wall charges are sufficiently accumulated on a dielectric layer covering the scan electrodes, the sustain electrodes and the data electrodes. And then, the voltage is slowly decreased to 0V from the discharge starting voltage (V_f)(for a time of $130\mu s$ to $150\mu s$: the discharge is not stable therebelow).

At this time, a voltage to be applied to the sustain electrodes is maintained at 0V while the discharge starting voltage (V_f) is applied to the scan electrodes, and then is slowly increased from 0V to about a sustain voltage (V_s) while the voltage to be applied to the sustain electrodes is slowly decreased to 0V from the discharge starting voltage (V_f). The voltage to be applied to the scan electrodes is maintained at 0V for a time of about $10\mu s$ after being slowly decreased to 0V, and at this time the voltage to be applied to the sustain electrodes is continuously maintained at the sustain voltage (V_s).

Thus, stable gas discharge phenomena with a short reset time can be obtained by combining waveforms of voltages to be applied to the scan electrodes and the sustain electrodes in the

reset period, thereby ensuring a broad driving margin of the panel, and solving problems on a high contrast, a high brightness and a false contour connected to improvement of display quality.

A wall charge state in the foregoing reset period is
5 described hereinafter.

If a pulse voltage for a strong discharge is applied to the scan electrodes, a large quantity of negative charges are accumulated on a dielectric layer covering the scan electrodes, and positive charges are formed on the sustain electrodes and the
10 data electrodes. As positive charges inflow from a discharge space onto the dielectric layer covering the scan electrodes during the period for which the voltage to be applied to the scan electrodes is slowly decreased to 0V after the discharge stabilizing time, the negative charges are weakened and weak negative charges remain
15 finally. As negative charges inflow from the discharge space onto the dielectric layer covering the sustain electrodes, the positive charges are eliminated and finally negative charges are accumulated instead.

As positive charges inflow from the discharge space onto
20 the dielectric covering the data electrodes, a little increased

positive charges remain.

Therefore, a negative wall voltage is accumulated on the scan electrodes, a negative wall voltage on the sustain electrodes, and a positive wall voltage on the data electrodes
5 when the reset period is finished.

A voltage of V_{y_level} is applied to all scan electrodes in the scan period and the voltage is maintained. Then, the scan voltage is decreased to 0V when a write voltage (V_d) is applied to selected data electrodes, thereby generating the write discharge.
10 In this state, the discharge voltage is calculated by adding a wall voltage accumulated between the dielectric covering the data electrode and the dielectric covering the scan electrode to the writing voltage (V_d) to be applied to the data electrode. Thus, a writing discharge is generated concurrently between the data
15 electrode and the scan electrode and between the scan electrode and the sustain electrode. In case that discharge is generated in the display cell, positive wall charges are accumulated on the scan electrodes, negative wall charges on the sustain electrodes, and negative wall charges on the data electrodes, and thus charges
20 are formed in good condition for sustain discharges before the

sustain period after the scan period is finished.

A voltage of 0V is applied to all scan electrodes, sustain electrodes and data electrodes at a first stage of the sustain period, and then after several μ s a sustain voltage (V_s) is applied to the scan electrodes. At this state, a discharge voltage is calculated by adding a wall voltage accumulated on the dielectrics of the scan electrodes and the sustain electrodes to the sustain voltage (V_s), thereby exceeding the discharge starting voltage.

After a discharge proceeds at this time, negative charges are accumulated on the dielectric layer covering the scan electrodes, and positive charges are accumulated on the dielectric layer covering the sustain electrodes.

Then, if the sustain voltage (V_s) is applied to the sustain electrode and a discharge is generated, positive charges are accumulated on the dielectric layer covering the scan electrodes, and negative charges are accumulated on the dielectric layer covering the sustain electrodes.

On the data electrodes during the sustain period, positive charges are continuously accumulated until saturation.

The above-mentioned discharges between the scan electrodes and the sustain electrodes are alternately generated during the sustain period.

Thus, as the whole sustain period proceeds, ultra-violet
5 rays are generated from discharge gas, thereby exciting phosphors and emitting visible light to be used for screen display.

In display cells not to be discharged during the above-mentioned operations, the charge distribution in the reset period, in which a negative wall voltage is accumulated on the
10 scan electrodes, a negative wall voltage on the sustain electrodes, and a positive wall voltage on the data electrodes, is maintained when a first subfield is finished.

Thus, the first subfield is finished and a second subfield starts.

15 During the reset period in any one subfield of a second to a tenth subfield, a reset voltage of the sustain voltage (V_s) is applied to the scan electrodes, instead application of a discharge starting voltage (V_f).

Since the sustain voltage (V_s) was applied to the display
20 cells discharged in the first subfield, the display cells are in

the state in which the positive wall voltage is accumulated on the scan electrodes, the negative wall voltage is accumulated on the sustain electrodes and the positive wall voltage is accumulated on the data electrodes.

5 At this time, if the sustain voltage (V_s) is applied to the scan electrode as a reset voltage in the second subfield, the same discharge as the sustain discharge is generated, and thus negative charges are accumulated on the dielectric covering the scan electrodes and positive charges are accumulated on the dielectric
10 covering the sustain electrodes. Henceforth, during a period for which the voltage to be applied to the scan electrodes is slowly decreased to 0V after maintaining for a discharge stabilizing time of 9 to 11 μ s, positive charges inflow from the discharge space onto the dielectric layer covering the scan electrodes, and thus
15 the negative charges are weakened and the weakened negative charges remain. And, negative charges inflow in a discharge space onto the dielectric layer covering the sustain electrodes, and therefore the positive charges are eliminated and negative charges are accumulated on the contrary. Furthermore, positive charges
20 inflow in the discharge space onto the dielectric covering the

data electrodes, and thus a little increased positive charges remain.

Since this discharge phenomenon is similar to the aforementioned result of the first subfield, it can be understood
5 that the wall charges accumulated on each of the scan electrode, the sustain electrode and the data electrode are identical in each of the reset periods of all subfields.

What attention is paid to in the present driving waveform is that a time interval between the last sustain voltage of the
10 previous subfield and the reset voltage of the next subfield has to be within $15\mu\text{s}$. The reason is because, if this time interval becomes long, the wall charges accumulated on the scan electrodes and the sustain electrodes are decreased after the discharge is generated with the last sustain voltage in the previous subfield,
15 and so a discharge is not properly generated with the reset voltage in the next subfield, thereby making the discharge unstable or generating a phenomenon of no discharge.

As described above, since a reset time used in the reset period is as very short as about $150\mu\text{s}$, more sustain pulses can be
20 applied, and therefore a high contrast and a high brightness can

be obtained. Furthermore, since ten subfields can be increased to twelve subfields due to a remaining time in the reset period, false contour can be solved.

A calculated time in each period is as follows.

5 In case of ten subfields, a reset period (1.5ms), a scan period (9.6ms), and a sustain period (5.6ms, 1120 times at a maximum) are comprised, and in case of twelve subfields, a reset period (1.8ms), a scan period (11.52ms), and a sustain period (3.38ms, 676 times at a maximum) are comprised.

10 Where the above-mentioned driving waveform is designed in the simplest way, the voltage to be applied to the scan electrode comprises the discharge starting voltage (V_f) used as a reset voltage in the first subfield, the sustain voltage (V_s) used in the second to the last subfield as a reset voltage and in all the
15 sustain periods, and a voltage of V_{y_level} used in the scan period. And, a sustain voltage (V_s) is only used in the sustain electrode and the writing voltage (V_d) in the data electrode.

 Therefore, three electric power sources are used for the scan electrodes, one electric power source is used for the sustain
20 electrodes and one electric power source is used for the data

electrodes. Accordingly, the driving of the plasma display panel is possible with total five electric power sources, thereby contributing immensely to reduction of cost in manufacturing the plasma display panel.

5 Additionally, since the voltage of V_{y_level} for the scan electrodes can be used together with the writing voltage (V_d) in the data electrode, thereby being capable of minimizing total electric power sources to four.

By the above-mentioned driving method, a high contrast of
10 the panel can be obtained because light is emitted only in the reset discharge of the first subfield for a black brightness. That is, although strong light is emitted in the reset period of the first subfield as shown in Fig. 10, such strong light is not emitted in the second to the last period as shown in Fig. 11.

15 Further, in case that the AC plasma display panel is realized using ten subfields, the black brightness is shown to be 0.3cd/m^2 and the maximum contrast is shown to be 2600 : 1 (see Figs 6 to 9).

In Figs. 6 to 8, relations of the write voltage (V_d) to the
20 sustain voltage (V_s) according to a change in each cell-off

voltage of R, B and G display cells, respectively are shown as graphs. In Fig. 9, a contrast ratio by each reset voltage between a black color and a white color according to one method of the present invention is illustrated as a graph. In Figs. 6 to 9, effect is shown to be prominent, particularly in the discharge starting voltages (V_f) between 270V and 320V, and in the sustain voltages (V_s) between 170V and 185V.

In a timing chart of Buffy Driving Waveform according to another embodiment of the present invention as shown in Fig. 4, a discharge stabilizing time of 9 to 11 μs is provided after a strong discharge generated by the discharge starting voltage (V_f) in the reset period of the first subfield, and then the discharge starting voltage (V_f) is slowly decreased to 0V after being abruptly dropped to a voltage at which a self-erase discharge is not generated.

At this time, the discharge voltage should be dropped from the discharge starting voltage (V_f) to the voltage for the self-erase discharge not to be generated, and all weak discharges should be generated only in a period for which to be dropped to 0V. The remaining all other periods are identical to those in the

above-mentioned embodiment of Fig. 3 and their effects are similar.

In a timing chart of Buffy Driving Waveform according to still another embodiment of the present invention as shown in Fig. 5, a discharge stabilizing time of 9 to 11 μ s is provided after a strong discharge generated by the discharge starting voltage (V_f) in the reset period of the first subfield, and then the discharge starting voltage (V_f) is slowly decreased to 0V after being abruptly dropped to a voltage at which a self-erase discharge is not generated and maintaining the voltage for a time of 9 to 11 μ s.

At this time, the discharge voltage should be dropped from the discharge starting voltage (V_f) to the voltage for the self-erase discharge not to be generated, and the discharge should not be generated for maintaining the voltage for a time of 9 to 11 μ s. All weak discharges should be generated only in a period for which to be dropped to 0V. The remaining all other periods are identical to those in the above-mentioned embodiment of Fig. 3 and their effects are similar.

In each embodiments of the method of driving an AC plasma

display panel according to the present invention, the characteristics of the voltage to be applied to the scan electrodes in the reset period is that the discharge starting voltage (V_f) of a high voltage is applied in the first subfield only, and a voltage below 200V, i.e., the sustain voltage (V_s) is applied from the second subfield to the tenth subfield. And the characteristics of the voltage to be applied to the sustain electrodes is that the sustain voltage (V_s) below 200V is applied for all subfields.

10 In a shape of the voltage to be applied to the scan electrodes and the sustain electrodes in the reset period, the voltage to be applied to the sustain electrodes is increased from 0V to the sustain voltage (V_s) for the same time when the voltage to be applied to the scan electrodes is increased to 0V from the discharge starting voltage (V_f) or the sustain voltage (V_s). Therefore, since a change in a potential difference between the scan electrode and the sustain electrode is small compared with the prior art waveform and acts on gas discharge stably, it is advantageous to have a short reset time.

20 Further, since the reset discharge displayed in a black is

generated only in the reset period of the first subfield among
all periods of the total ten subfields, outstanding advancement in
the contrast can be achieved. And, a plasma display panel with a
high brightness can be obtained on account of an increase in the
5 number of the sustain pulses due to the short reset time.

Furthermore, the shape of the voltage to be applied in the
reset periods of all subfields is identical, and thus the cost to
manufacture the plasma display panel can become very low by
simplifying circuits.

10 Therefore, according to the configuration and acting of the
method of driving an AC plasma display panel in accordance with
the embodiments of the present invention described above, charge
control is very easy, a reset voltage is substantially lowered and
a Buffy Driving Waveform using a positive electric power source
15 only is realized in a selective write method, thereby capable of
obtaining a high contrast above 2000:1 in the 10 bit subfield and
a high brightness above 700cd/m². Further, a decrease of false
contour is obtained through a timing design of twelve subfields
depending on the decrease of the reset time.

Claims

1. A method of driving an AC plasma display panel which comprises multiple scan electrodes and multiple sustain electrodes to be arranged in parallel on one surface of opposite surfaces of a front substrate and a rear substrate and multiple data electrodes to be arranged on other surface of opposite surfaces of the front substrate and the rear substrate so as to form each display cell for discharge in each region crossing with the scan electrodes and the sustain electrodes, wherein one frame of inputted video signals is divided into multiple subfields each of which comprises a reset period, a scan period and a sustain period, wall charges being accumulated uniformly on the whole display cells during the reset period, selective write discharges being executed on display cells to be turned on during the scan period, and sustain discharges being executed so as to turn on the write-discharged display cells during the sustain period, said sustain period being differently set with specific weighted values in each divided subfield, so as to display gray scales by combining each subfield, said method being characterized in that:
- a voltage (pulse wave) abruptly increased to a voltage for

starting a discharge (V_f) is applied to the scan electrodes in the reset period of a first subfield of each frame;

the voltage to be applied to the scan electrodes is maintained at the discharge starting voltage (V_f) for a discharge
5 stabilizing time after the discharge starts for which wall charges are sufficiently accumulated on a dielectric layer covering the scan electrodes, the sustain electrodes and the data electrodes;

subsequently, the voltage to be applied to the scan electrodes is slowly decreased to 0V from the discharge starting
10 voltage (V_f); and

a voltage to be applied to the sustain electrodes is maintained at 0V while the discharge starting voltage (V_f) is applied to the scan electrodes, and then is slowly increased from 0V to about a sustain voltage (V_s) while the voltage to be applied
15 to the sustain electrodes is slowly decreased to 0V from the discharge starting voltage (V_f).

2. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that a voltage to be applied to all data electrodes is maintained at 0V in the reset
20 period of the first subfield of each frame.

3. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that the discharge stabilizing time is $9\mu\text{s}$ to $11\mu\text{s}$, and a time to slowly decrease from the discharge starting voltage (V_f) to 0V is $30\mu\text{s}$ to $150\mu\text{s}$.
- 5 4. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that the voltage to be applied to the scan electrodes after being slowly decreased from the discharge starting voltage (V_f) to 0V is maintained at 0V for a time of $9\mu\text{s}$ to $11\mu\text{s}$, and at this time the voltage to be applied
10 to the sustain electrodes is maintained at the sustain voltage (V_s).
5. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that a voltage to be applied to all scan electrodes is maintained at a scan voltage
15 (V_{y_level} voltage) during the scan period, and at this state the scan voltage is decreased to 0V when a write voltage (V_d) is applied to selected data electrodes, thereby generating the write discharge; and that a voltage of 0V is applied to all scan electrodes, sustain electrodes and data electrodes at a first
20 stage of the sustain period, and then after several μs a sustain

voltage (V_s) is applied to the scan electrodes and the sustain electrodes, alternately.

6. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that, during the reset
5 period in any one subfield of a second to a last subfield of the frame, the sustain voltage (V_s) is applied to the scan electrodes for the discharge stabilizing time within a time of $15\mu s$ after a last sustain voltage (V_s) of a previous subfield is applied, and then is slowly decreased to 0V; and

10 a voltage to be applied to the sustain electrodes is maintained at 0V while the sustain voltage (V_s) is applied to the scan electrodes, and then is slowly increased to about the sustain voltage (V_s) while the voltage to be applied to the scan electrodes is slowly decreased to 0V.

15 7. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that:

the voltage to be applied to the scan electrodes is maintained at 0V for a time between 9 to $11\mu s$ after the voltage to be applied to the scan electrodes is dropped to 0V from the
20 discharge starting voltage (V_f) and at this time the voltage to be

applied to the sustain electrodes is continuously maintained at the sustain voltage (V_s);

a voltage to be applied to all scan electrodes is maintained at a scan voltage (V_{y_level} voltage) during the scan period, and at this state the scan voltage is decreased to 0V when
5 a write voltage (V_d) is applied to selected data electrodes, thereby generating the write discharge;

a voltage of 0V is applied to all scan electrodes, sustain electrodes and data electrodes at a first stage of the sustain period, and then after several μs a sustain voltage (V_s) is
10 applied to the scan electrodes and the sustain electrodes, alternately;

during the reset period in any one subfield of a second to a last subfield of the frame, the sustain voltage (V_s) is applied
15 to the scan electrodes for the discharge stabilizing time within a time of $15\mu s$ after a last sustain voltage (V_s) of a previous subfield is applied, and then is slowly decreased to 0V, and a voltage to be applied to the sustain electrodes is maintained at 0V while the sustain voltage (V_s) is applied to the scan
20 electrodes, and then is slowly increased from 0V to about the

sustain voltage (V_s) while the voltage to be applied to the scan electrodes is slowly decreased to 0V from the sustain voltage (V_s), so that three electric power sources are used for the scan electrodes, one electric power source is used for the sustain electrodes and one electric power source is used for the data electrodes.

8. A method of driving an AC plasma display panel according to claim 7, said method being characterized in that total electric power sources to be used together with an electric power source for applying the scan voltage (V_{y_level} voltage) as the write voltage are reduced to minimum four electric power sources.

9. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that the discharge starting voltage (V_f) is between 270V and 320V, and the sustain voltage (V_s) is between 170V and 185V.

10. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that the step of slowly decreasing the voltage from the discharge starting voltage (V_f) to 0V comprises the steps of abruptly dropping the voltage from the discharge starting voltage (V_f) to a voltage at which a

self-erase discharge is not generated, and then slowly decreasing the voltage to 0V.

11. A method of driving an AC plasma display panel according to claim 1, said method being characterized in that

5 the step of slowly decreasing the voltage from the discharge starting voltage (V_f) to 0V comprises the steps of abruptly dropping the voltage from the discharge starting voltage (V_f) to a voltage at which a self-erase discharge is not generated, maintaining the voltage at the voltage for the self-erase
10 discharge not to be generated for a time of 9 to 11 μ s, and then slowly decreasing the voltage to 0V.

12. A method of driving an AC plasma display panel which comprises multiple scan electrodes and multiple sustain electrodes to be arranged in parallel on one surface of opposite surfaces of
15 a front substrate and a rear substrate and multiple data electrodes to be arranged on other surface of opposite surfaces of the front substrate and the rear substrate so as to form each display cell for discharge in each region crossing with the scan
electrodes and the sustain electrodes, wherein one frame of
20 inputted video signals is divided into multiple subfields each of

which comprises a reset period, a scan period and a sustain period, wall charges being accumulated uniformly on the whole display cells during the reset period, selective write discharges being executed on display cells to be turned on during the scan period, and sustain discharges being executed so as to turn on the write-discharged display cells during the sustain period, said sustain period being differently set with specific weighted values in each divided subfield, so as to display gray scales by combining each subfield, said method being characterized in that:

10 during the reset period in any one subfield of a second to a last subfield of the frame, the sustain voltage (V_s) is applied to the scan electrodes for a discharge stabilizing time within a time of $15\mu s$ after a last sustain voltage (V_s) of a previous subfield is applied, and then is slowly decreased to 0V; and

15 a voltage to be applied to the sustain electrodes is maintained at 0V while the sustain voltage (V_s) is applied to the scan electrodes, and then is slowly increased to about the sustain voltage (V_s) while the voltage to be applied to the scan electrodes is slowly decreased to 0V.

20 13. A method of driving an AC plasma display panel according to

claim 12, said method being characterized in that a voltage to be applied to all data electrodes is maintained at 0V in the reset periods of the subfields.

14. A method of driving an AC plasma display panel according to claim 12, said method being characterized in that the discharge stabilizing time is $9\mu\text{s}$ to $11\mu\text{s}$, and a time to slowly decrease from the discharge starting voltage (V_f) to 0V is $30\mu\text{s}$ to $150\mu\text{s}$.

15. A method of driving an AC plasma display panel according to claim 12, said method being characterized in that the voltage to be applied to the scan electrodes after being slowly decreased from the discharge starting voltage (V_f) to 0V is maintained at 0V for a time of $9\mu\text{s}$ to $11\mu\text{s}$, and at this time the voltage to be applied to the sustain electrodes is maintained at the sustain voltage (V_s).

16. A method of driving an AC plasma display panel according to claim 12, said method being characterized in that a voltage to be applied to all scan electrodes is maintained at a scan voltage (V_{y_level} voltage) during the scan period, and at this state the scan voltage is decreased to 0V when a write voltage (V_d) is applied to selected data electrodes, thereby generating the write

discharge; and that a voltage of 0V is applied to all scan electrodes, sustain electrodes and data electrodes at a first stage of the sustain period, and then after several μ s a sustain voltage (V_s) is applied to the scan electrodes and the sustain electrodes, alternately.

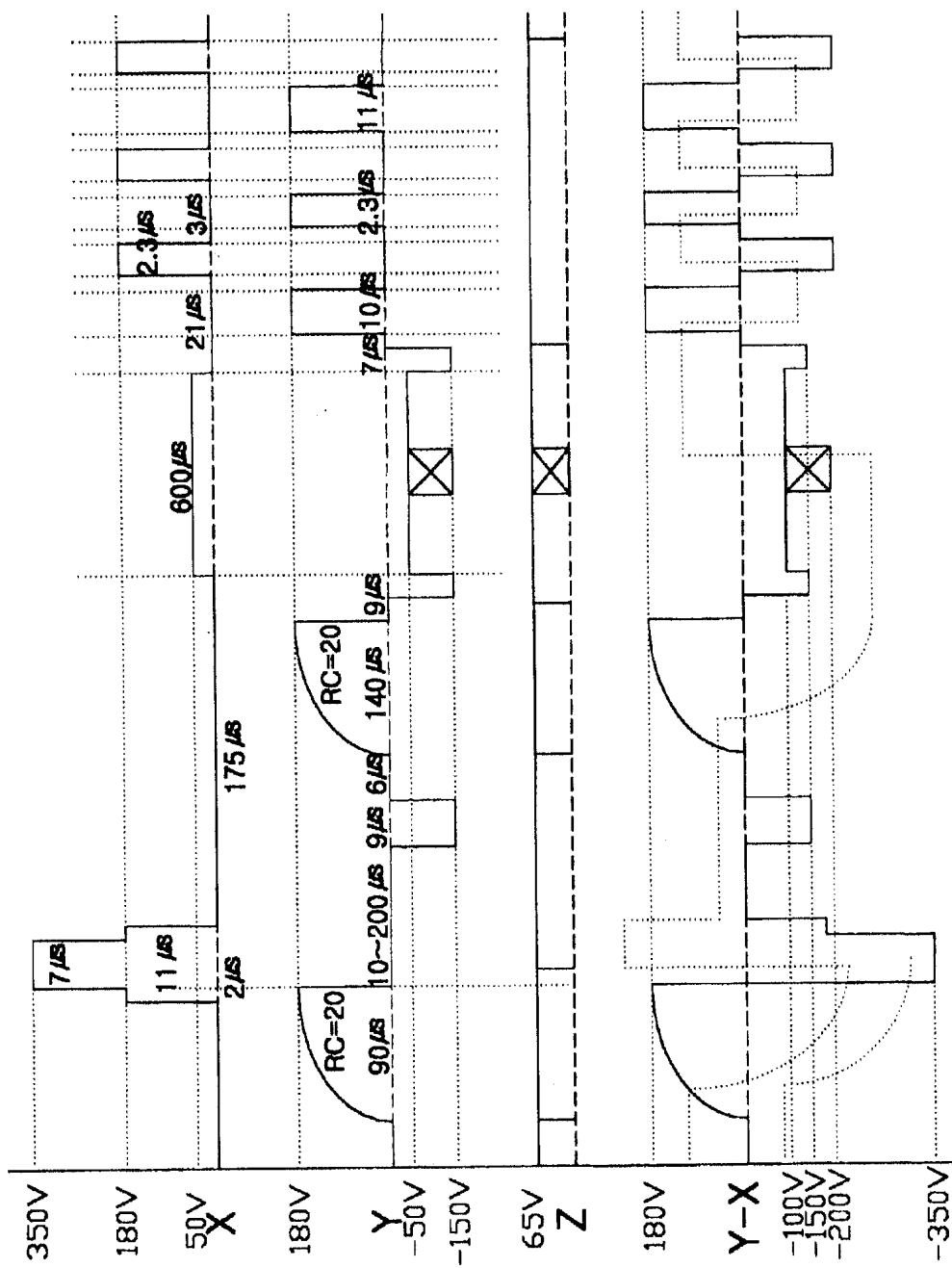
17. A method of driving an AC plasma display panel according to claim 12, said method being characterized in that the sustain voltage (V_s) is between 170V and 185V.

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FIG. 1



2/11

FIG. 2

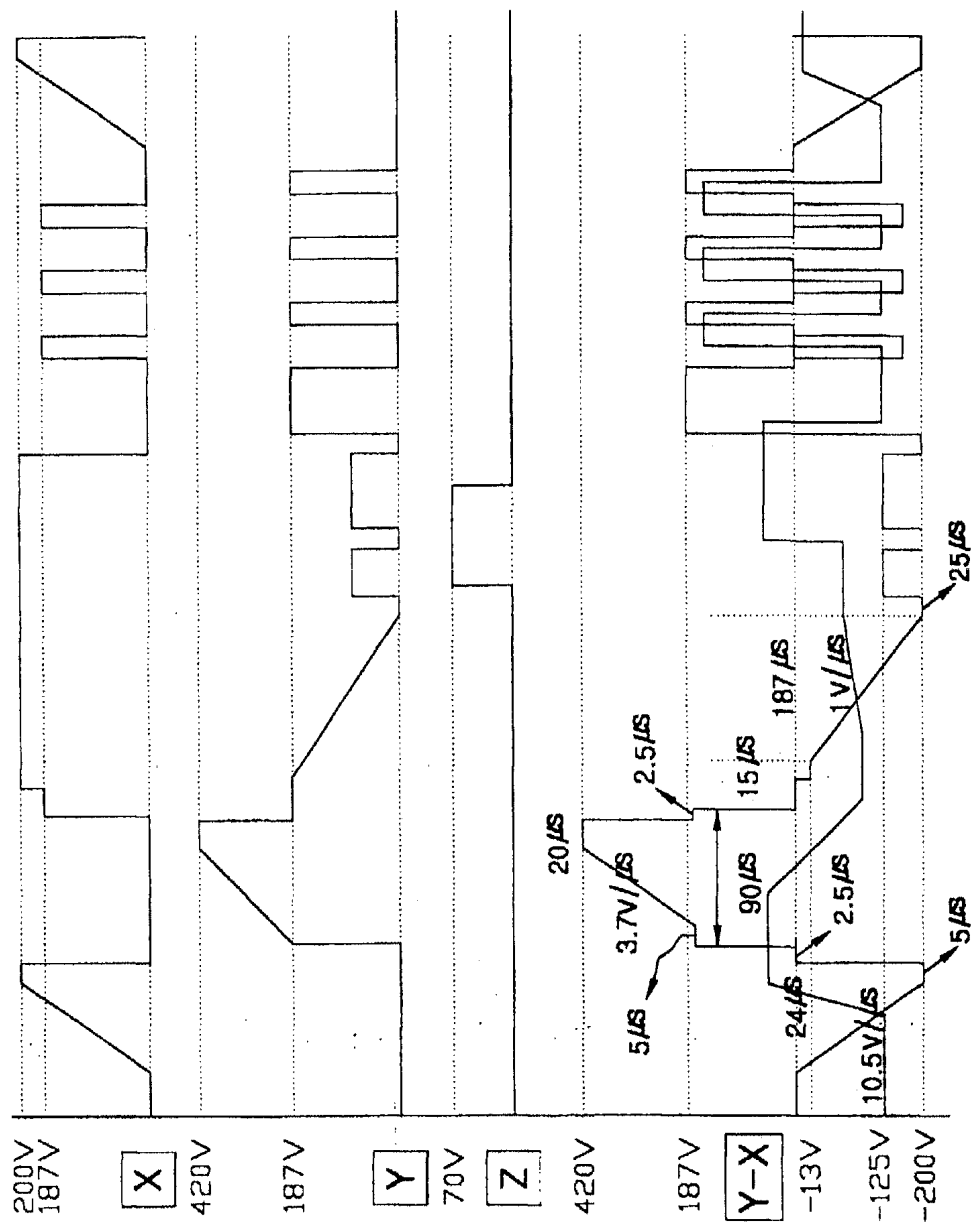


FIG. 3

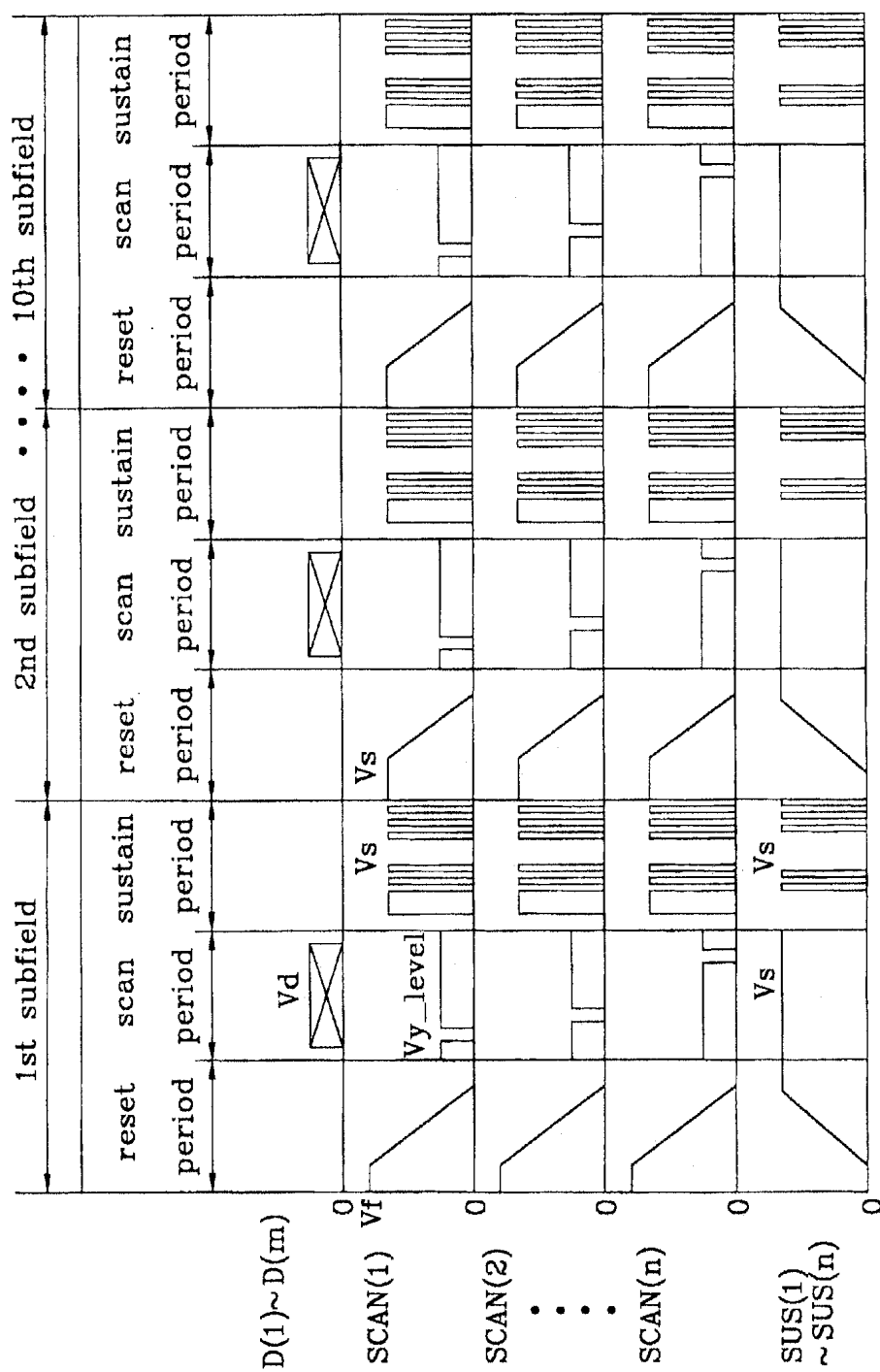


FIG. 4

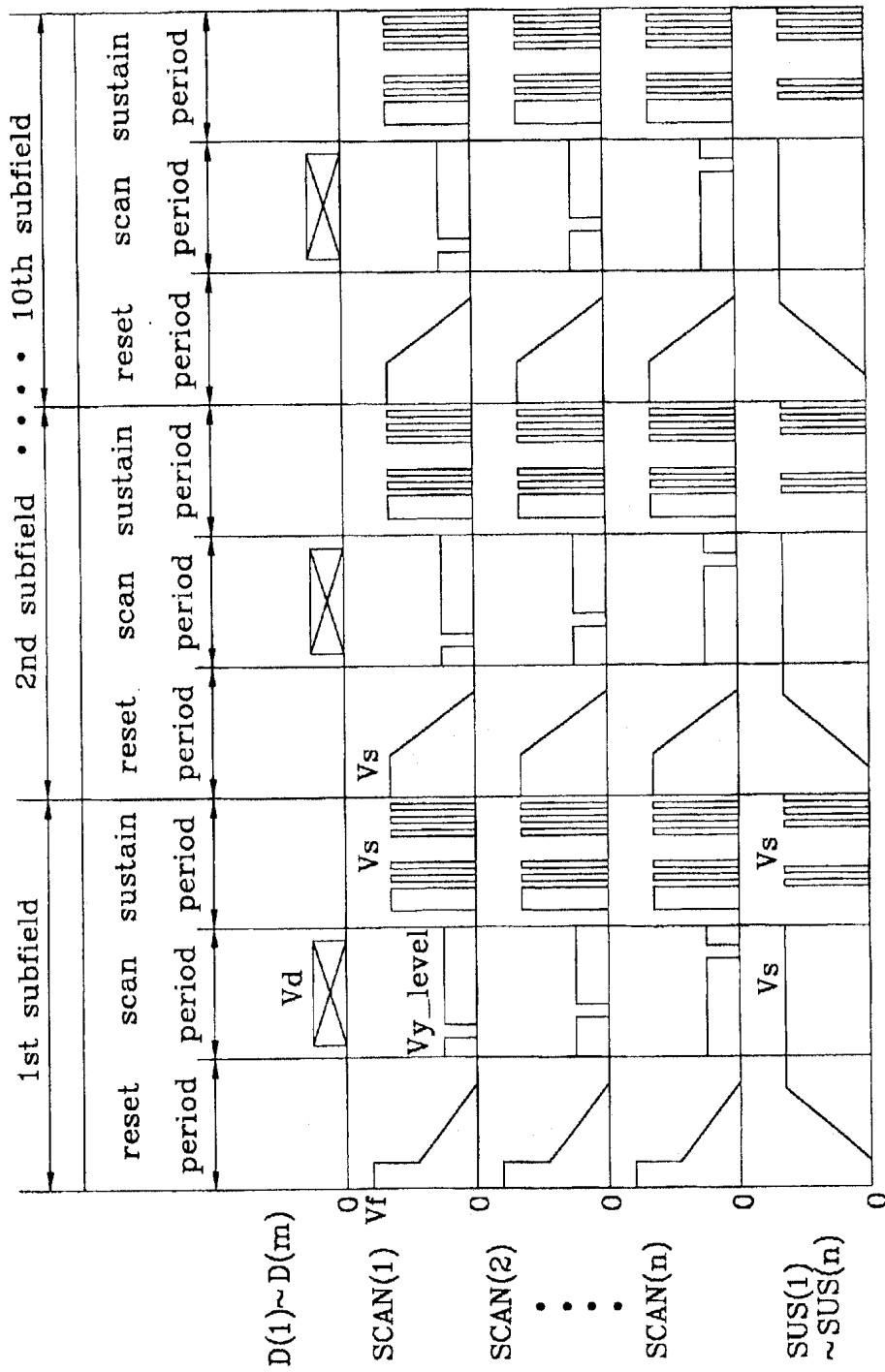
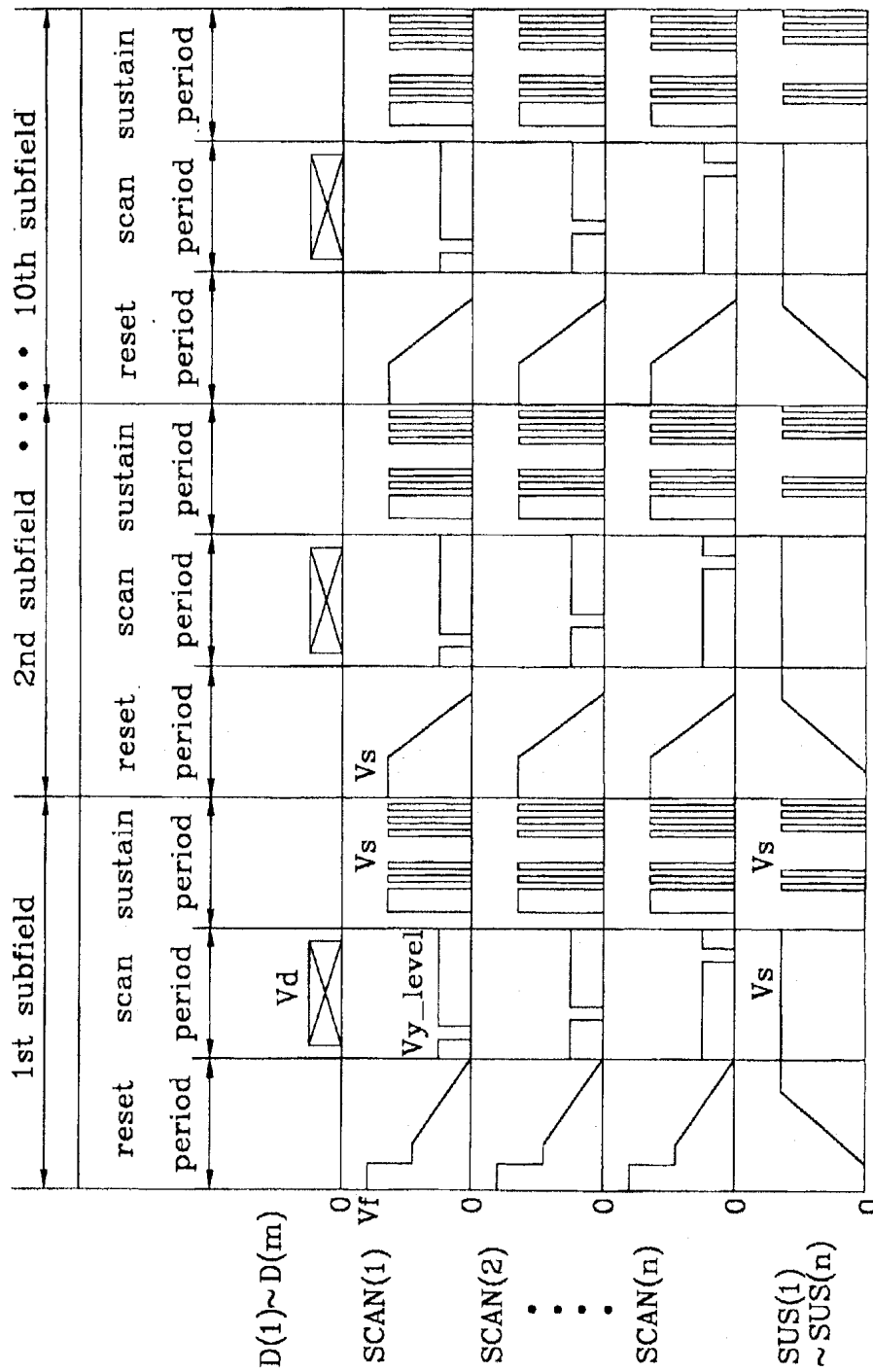
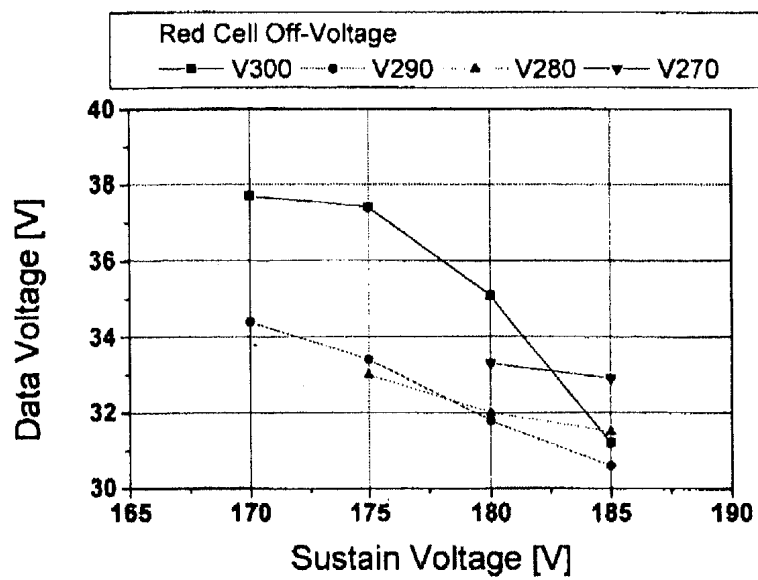


FIG. 5



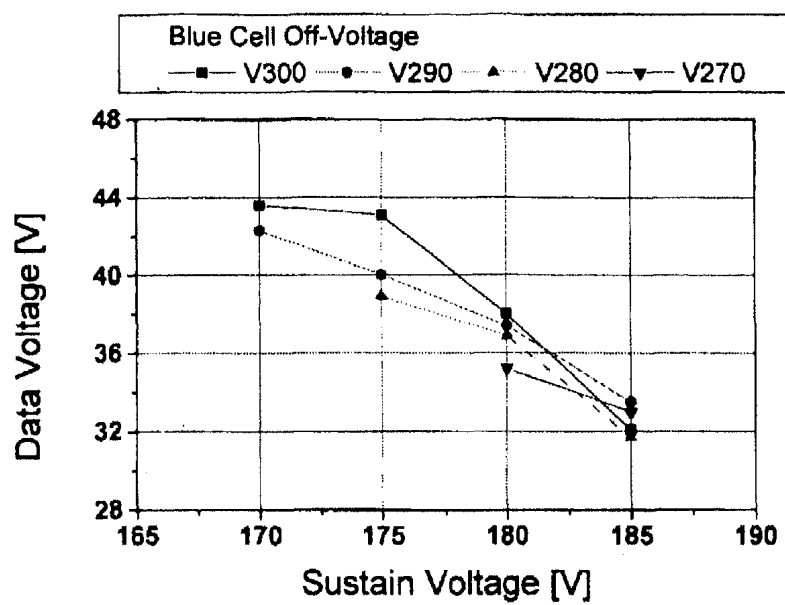
6/11

FIG. 6



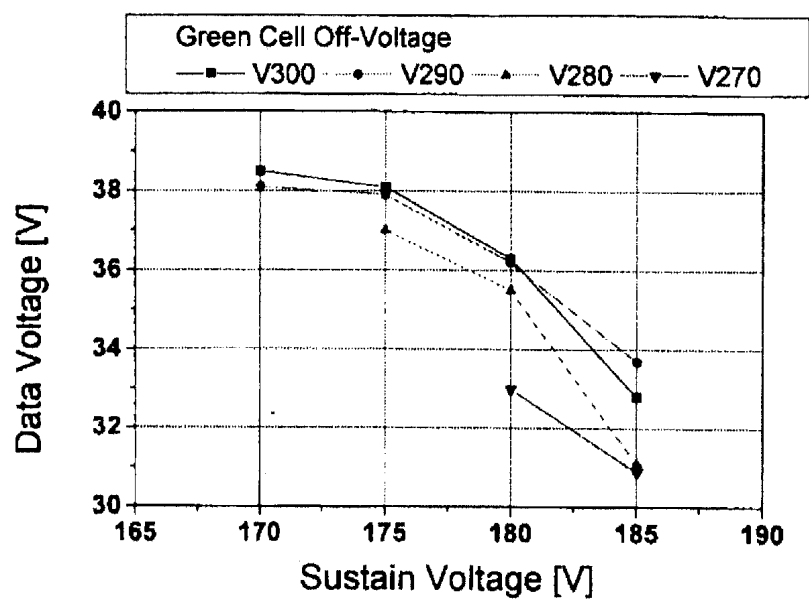
7/11

FIG. 7



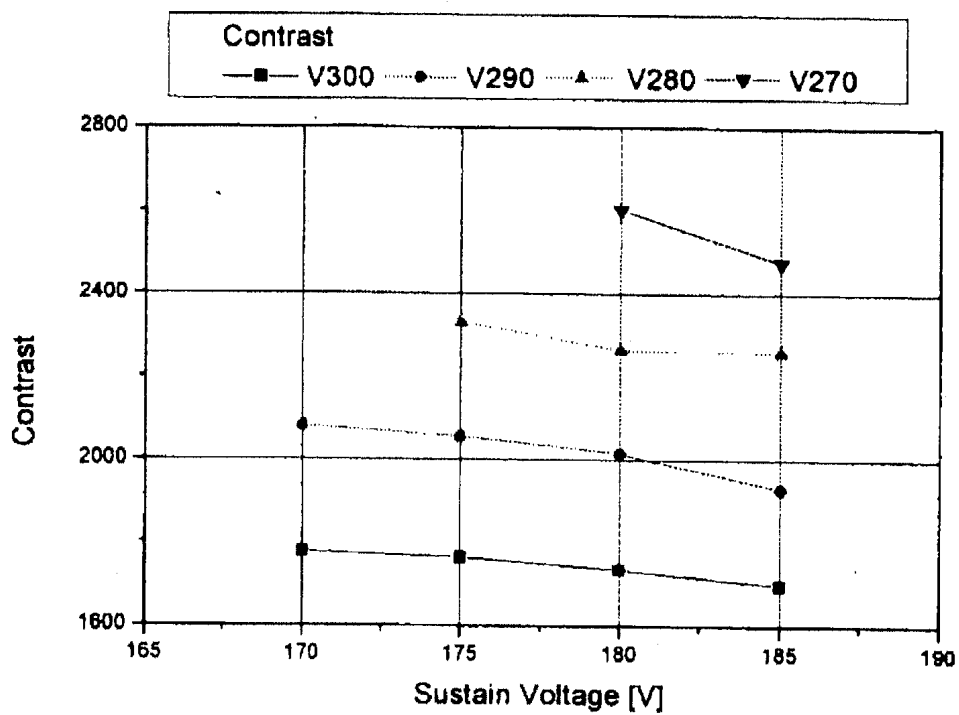
8/11

FIG. 8



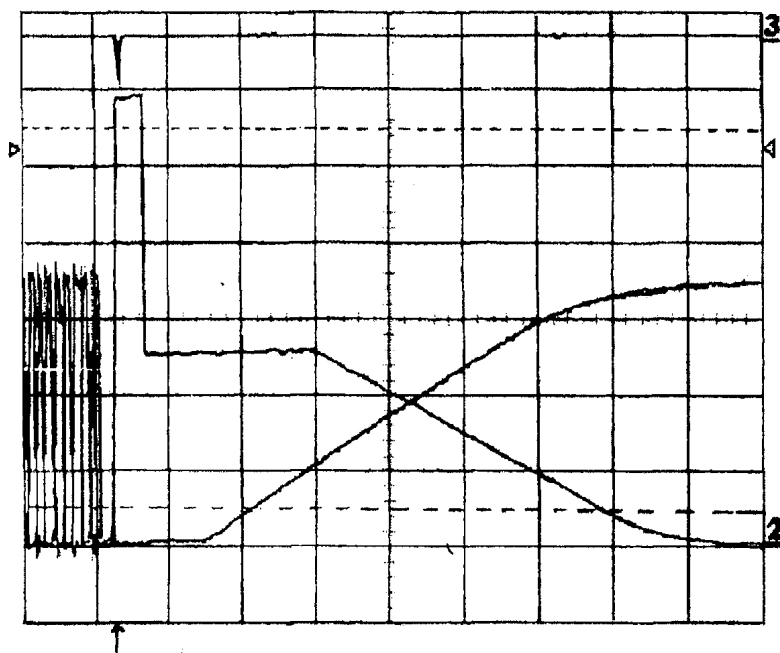
9/11

FIG. 9



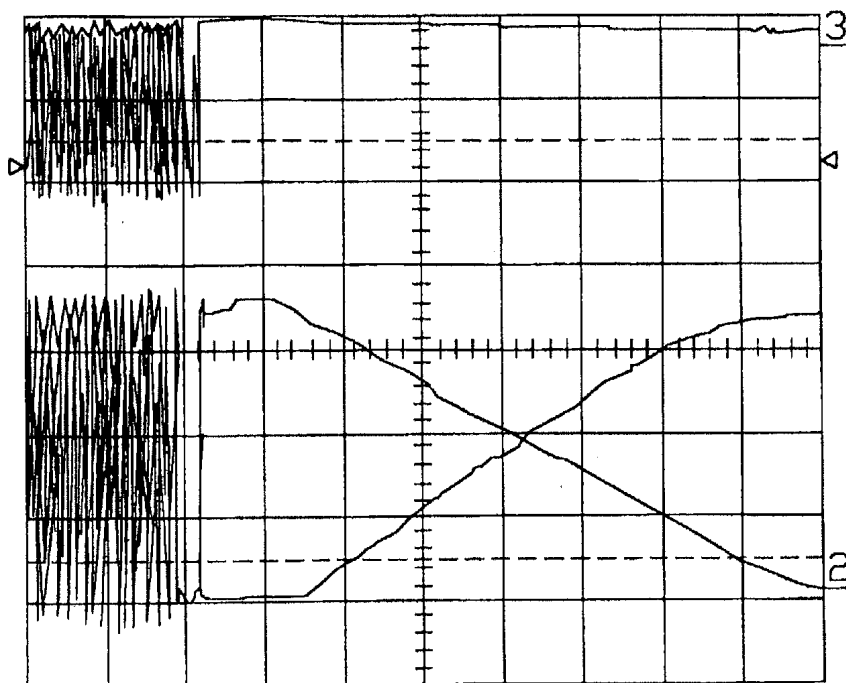
10/11

FIG. 10



11/11

FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR01/01733

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 G09G 3/288**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 G09G3, H01J11, H01J17

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

PATROM, KPA SINCE 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ "DRIV""SLOPE""SUSTAIN""PULSE"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 2000-0053490(NEC) 25 AUGUST 2000 WHOLE DOCUMENT	1-17
A	JP11-015436(PIONEER) 22 JANUARY 1999 WHOLE DOCUMENT	1-17
A	JP11-065514(NEC) 9 MARCH 1999 WHOLE DOCUMENT	1-17

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search

27 MARCH 2002 (27.03.2002)

Date of mailing of the international search report

28 MARCH 2002 (28.03.2002)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 920 Dunsan-dong, Seo-gu,
Daejeon Metropolitan City 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KIM, Joon Han

Telephone No. 82-42-481-5846

